

*An abstract of a Letter from Mr. Anthony Leevvenhoeck at Delft, dated Sep. 17. 1683. containing some Microscopical Observations, about Animals in the scurf of the Teeth, the substance call'd Worms in the Nose, the Cuticula consisting of Scales.*

**I** Formerly sent some Observations about Spittle, which I find have been Printed in the Lectures and Collections of Mr. R. H. in the year 1678. Since that time I have often observed my Spittle, out of this Consideration, that if there be any Animals dispersed in our Body, they may at some time or other, be emptied out of the *Ductus Salivales* into the Mouth. But my expectation in this particular has fail'd, for I have perceived no Animals, or other thing in Spittle than what I formerly mentioned.

Tho my Teeth are kept usually very clean, nevertheless when I view them in a Magnifying Glafs, I find growing between them a little white matter as thick as wetted flower: in this substance tho I could not perceive any motion, I judg'd there might probably be living Creatures.

I therefore took some of this flower and mixt it either with pure rain water wherein were no Animals; or else with some of my Spittle (having no Air bubbles to cause a motion in it) and then to my great surprize perceived that the aforesaid matter contained very many small living Animals, which moved themselves very extravagantly. the biggest sort had the shape of *A.* their motion was strong and nimble, and they darted themselves thro the water or spittle, as a Jack or Pike does thro the water. These were generally not many in number. The  
2d. sort

2d. sort had the shape of *B.* these spun about like a Top, and took a course sometimes on one side, as is shown at *G.* and *D.* they were more in number than the first. In the 3d. sort I could not well distinguish the Figure, for sometimes it seem'd to be an Oval, and other times a Circle. These were so small that they seem'd no bigger than *E.* and therewithal so swift, that I can compare them to nothing better than a swarm of Flies or Gnats, flying and turning among one another in a small space. Of this sort I believe there might be many thousands in a quantity of water no bigger than a sand, tho the flower were but the 9th. part of the water or spittle containing it.

Besides these Animals there were a great quantity of streaks or threds of different lengths, but like thickness, lying confusely together, some bent, and others streight as at *F.* These had no motion or life in them, for I well observed them, having formerly seen live-Animals in water of the same figure.

I observed the Spittle of two several women, whose Teeth were kept clean, and there were no Animals in the spittle; but the meal between the teeth, being mixt with water, (as before) I found the Animals above described, as also the long particles.

The Spittle of a Child of 8 years old had no living Creatures in it, but the meal between the Teeth, had a great many of the Animals above described, together with the streaks.

The Spittle of an old Man that had lived soberly, had no Animals in it; But the substance upon and between his Teeth, had a great many living Creatures, swimming nimbler then I had hitherto seen. The biggest sort were numerous, and as they moved, bent themselves like *G.* The other sorts of Animals were in great numbers, insomuch that tho the meal were little, yet the water it was mixt with seem'd to be all alive, there were also the long threads above mentioned.

The Spittle of another old man and a good fellow was like the former, but the Animals in the scurf upon the teeth, were not all killed by the parties continual drinking Brandy, Wine, and Tobacco, for I found a few living Animals of the 3<sup>d</sup>. sort, and in the scurf between the Teeth I found many more small Animals of the 2 smallest sorts.

I took in my mouth some very strong wine-Vinegar, and closing my Teeth, I gargled and rinsed them very well with the Vinegar, afterwards I washt them very well with fair water, but there were an innumerable quantity of Animals yet remaining in the scurf upon the Teeth, yet most in that between the teeth, and very few Animals of the first sort *A*.

I took a very little wine-Vinegar and mixt it with the water in which the scurf was dissolved, whereupon the Animals dyed presently. From hence I conclude, that the Vinegar with which I washt my Teeth, kill'd only those Animals which were on the outside of the scurf, but did not pass thro the whole substance of it.

In many of my foregoing Observations, I saw some clear shining Particles, whereof some were round, others somewhat irregular, of several bignesses, and the largest about 25 times the bulk of a blood-Globule, these if they had not sunk in water, I should have taken for Particles of fat.

The number of these Animals in the scurf of a mans Teeth, are so many that I believe they exceed the number of Men in a kingdom. For upon the examination of a small parcel of it, no thicker than a Horse-hair, I found too many living Animals therein, that I guess there might have been 1000 in a quantity of matter no bigger then the  $\frac{1}{100}$  part of a sand.

A certain man being said to have worms taken out of his face, I took a quantity of these imagined worms, which I laid upon a clean Glass, that I might view them  
at

at my leisure. I found them not to differ from what I gave an Account of in my Letter of the 4<sup>th</sup> of *Novemb.* 1681. unless it were that some of the hairs in these supposed worms were so tender, that they broke in two upon the least touch, Other worms seem'd to be a bundle of hairs, but when I went to separate them, it was just as if I had toucht a soft fat body.

I squeezed some black specks out of the thick of my own Nose, which I saw to be bundles of hairs, I then took out hairs from one of them to the number of 36.

*Fig. A. B. C. D. E.* is a bundle of hairs, as it appears in a Microscope, the part *A. B. C.* before I took it out of my Nose, lay even with the skin, and appear'd like a black speck; the hairs were not all of a length, but one stood out more than another, as at *B.* a single hair standing out as *B.* was transparent, and in the lower part of the bundle *C. D. E.* *A.* all the hairs together were transparent. In some bundles of hairs the part next the skin lay quite even, as if it had been cut with a pair of fizers. *E. D.* were the roots of hairs, lying one of them deeper than another.

I took the worms out of the Noses of 2 other persons, and I found the number of hairs in a bundle, to be from 3, 4, 5, 6, and 9. to 25, and 30. when the worms lay deepest in the Nose, they seldom contained any hairs, unless the person they came from were very black, and then the hairs were more easily perceivable.

In the pressing out of worms, I could tell whether there were hairs in them or no, for if the substance came out streight, then there were always hairs, but if bended and bow'd, none.

The make and conformation of these worms, I suppose to be after this manner. When the Root of a hair lying deep in the skin, supplies so much nourishment as to make the hair grow out and appear upon the face, the upper part of the hair by rubbing, or some other violence, comes

comes often to be broke off, the Trunk of it still remaining in the skin. When new matter is supplied, another hair grows by the side of the former, that was broken; and this so often till there comes sometimes to be 8. 10. 20. or 36. in a bundle. Yet this number is not made up in 1. or 2. years, but probably in a great many.

The reason of this my conclusion, is grounded upon the bluntness of the tops of all the hairs found in these worms, whereas all the other hairs growing upon the face are sharp-pointed, till such time as they come to be broken.

In the year 1674. I writ to Mr. *Oldenburg* that I found the *Cuticula*, or uppermost skin of a body to consist of round Particles or Scales: I also gave him my Opinion, how this skin was made, and how the upper part of it was worn off, and the under part came to succeed in its place.

Since that time there was little difference in what I observed, until now of late, that I have made use of another way. For at first I saw by a common Microscope the parts of the Scales appearing to the Eye as they were round, lying close in order, and so small that a sand would cover 200, or 250, of them, as is here shewn in *Fig. H*. But examining them since, by a Glass which magnified more, I am satisfied that they are not made out of the grosser part of the moisture or substance which is evaporated out of the body, as I formerly thought, but are meer Scales, such as grow upon the outward skin of a fish, and are called fish-scales.

These Scales lye upon our body, just as they do upon fishes, the most part of them are *quinque-lateral*, the figure of a whole one is here shewn by a magnifying Glass at *K*, the side *O. P.* was fastned to the skin, and is not so broad as if it be measured higher. Some of the Scales were not so long as *K*, and some had not the sides so even, but these last I took to be pulled off the body before they were fully grown. They are very thin, for I judge their breadth is above 25 times more than their thickness.

ness. They lie three deep upon the body, every part being covered with 3 scales successively, tho not above  $\frac{1}{3}$  part of a scale discover it self to the Eye, the other  $\frac{2}{3}$  parts being hid by the other scales. As *Fig. M.* where the part exposed to view is marked 1, 2, 3, 4. the rest is covered by other scales. The point 3 is not always so sharp as I have here made it, but it being like the Original, which seem'd a perfect scale, I would not alter it.

The scales of Fishes also appear but in part to the Eye, but it is very observable tho fishes never change their scales; yet men do often. Particularly I instance in my self at this time, being the *first* of *September*. That the scales came off me not by one and one, but 1000 in a Cluster. When I pluck off a scale from my body which sticks fast, and perhaps is but newly grown, there comes blood after it, or at least there remains a red spot,

I took off the skin from a scar in my Arm, caused by blood-letting 25 years since, and found the scales to have the shape of *L.*

Thro many of the aforesaid scales, there run transparent lines, in an odd manner, as at *M.* and these lines are sometimes stuck with round Balls, of the bigness of  $\frac{1}{4}$  a blood-globule, as may be seen in the same Figure.

These lines, I believe are caused by the sweat of the body, bringing with it some gross substances which adhere to the scales; the Globules also may either come whole out of the body, or else be made afterwards out of the matter which is evaporated.

It's easy to conceive how a Louse, Flea, or other insect may thrust his sting or snout into the skin, for they need not do it thro the scales, but between the Plates or Mailles.

From hence also may be gathered, that there are no pores in the *Cuticula*, for the conveying out of sweat, because that may owze out from between the scales, tho they stick never so close together, without supposing

supposing that there are channels made for its passage: Let us only reckon how many Vacuities a Scale has, whereby it is nourisht so as to grow, and that in the space of  $\frac{1}{3}$  part of a scale there may be 100 such Vacuities, thro which the humours of the body may pass, and that 200 such parts of a scale may be covered with a sand. It will follow then, that the body may exhale out of 20000 places in a quantity no bigger then what a sand will cover.

Hereout might be concluded that our Body is nothing but a Pore, notwithstanding what our Physicians speak of the Pores or passages for sweat, as if there were such places contriv'd by Nature for nothing else. For a drop of sweat though by the pressure of the Air it becomes round, yet it may be compounded of Particles coming from many thousand places.

I took some scales coming from the inward and most callous part of the hand, and found them of the same circumference with them of my Body, but as the one sort were very clear and transparent, so the other were so full of lines and so thick beset with Globules, that they seemed to be composed of nothing else; now we find by experience that the hand not only between the fingers, but in the hollow of it, is subject to be moist, more than other parts of the body; so that tho the scales fall off from the other parts of the body for want of nourishment, yet the scales upon the hands and feet are still kept on by a clammy moisture and fat, which being brought to that place to be evacuated, sticks to the Scales, and keeps them together, leaving only some small out-lets for the thinnest of the matter. By this means the skin of the hand, tho it be nothing but scales, comes to be of an extraordinary thickness, which may be increast by hard labour, whereby the moisture is brought into those parts, and the scales are more packed and clotted together.

*A Let-*

Fig. 1.

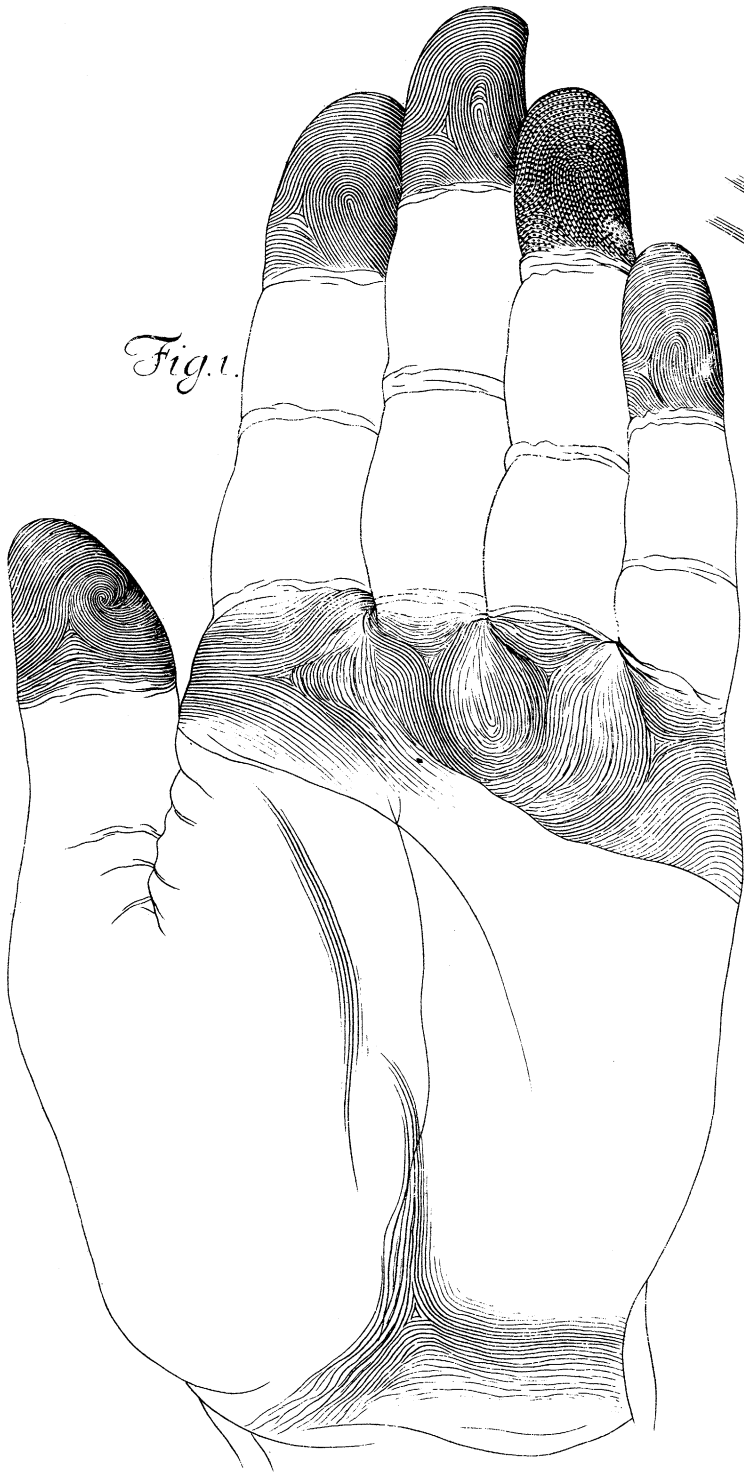


Fig. 2.

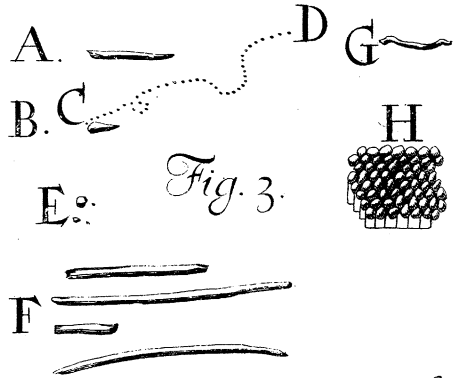
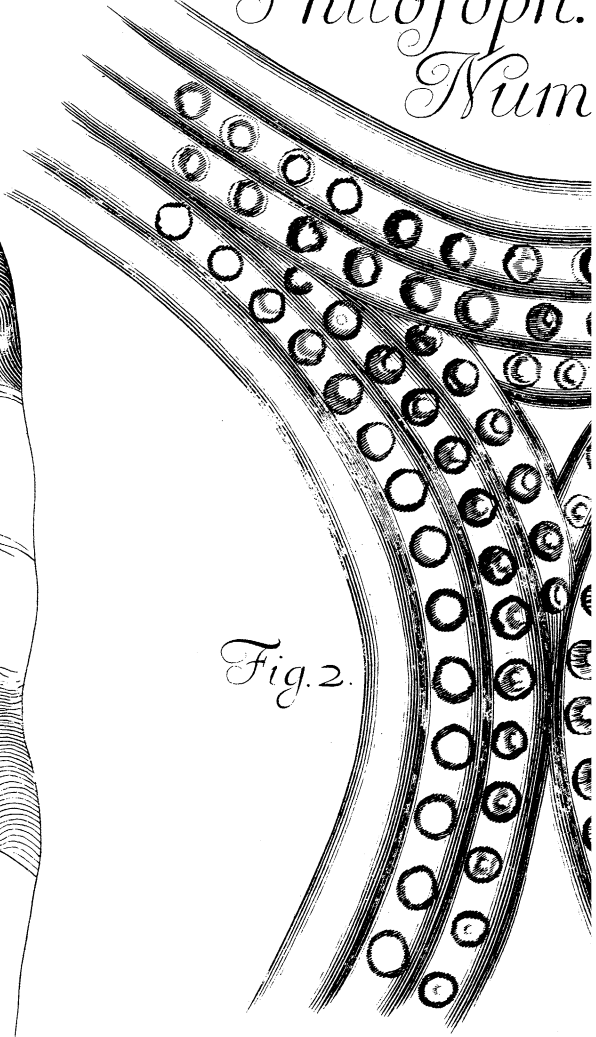


Fig. 3.



ph. Transact.  
 Umb. 159.

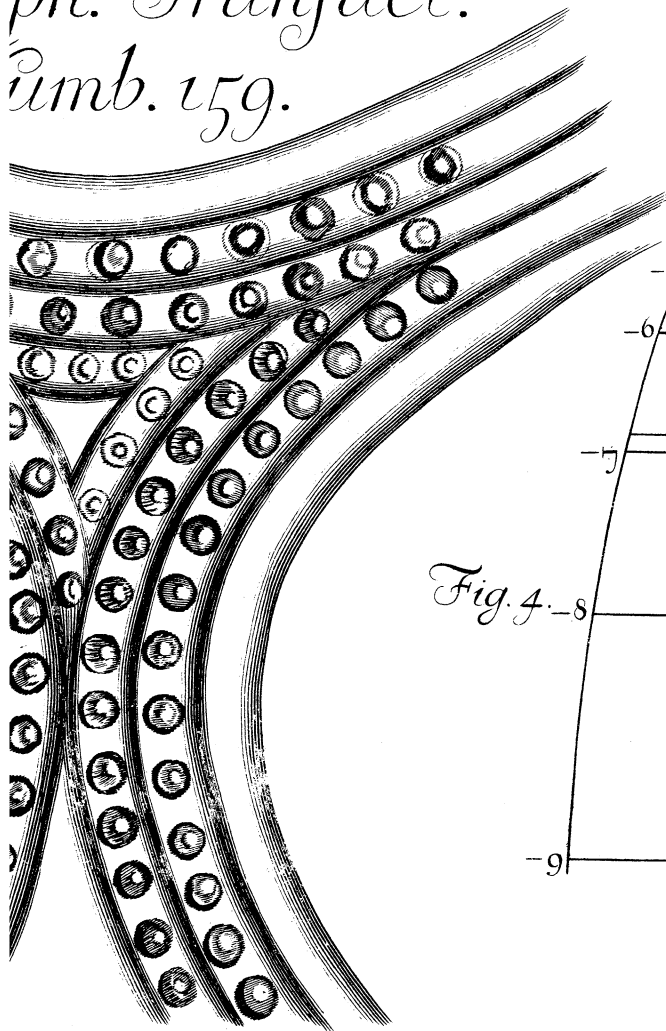
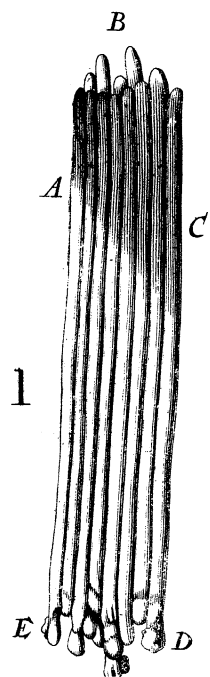
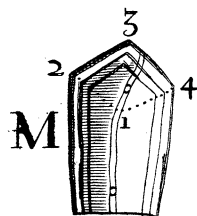
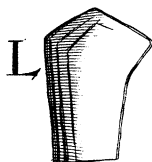
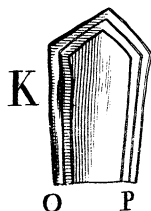
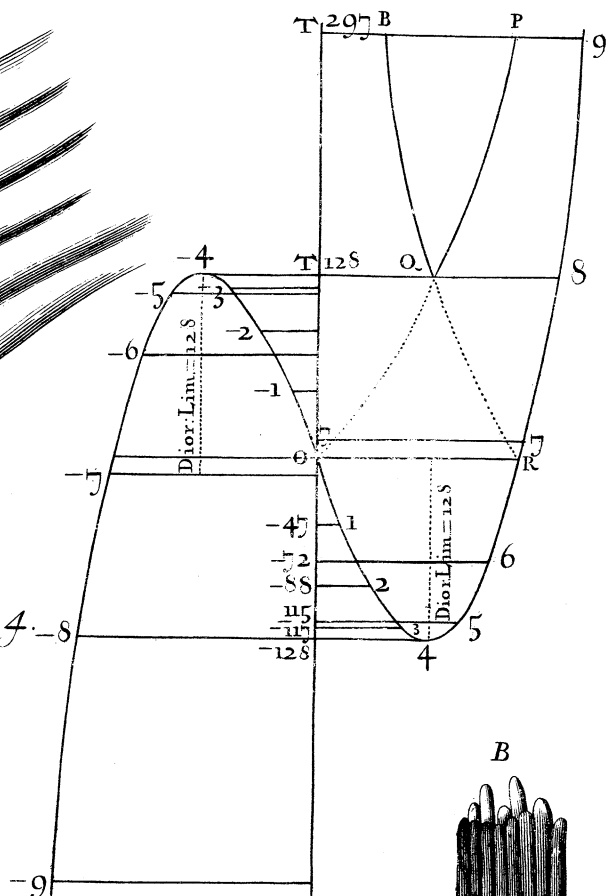


Fig. 4.



sculp.

Fig. 1.



Fig. 2.

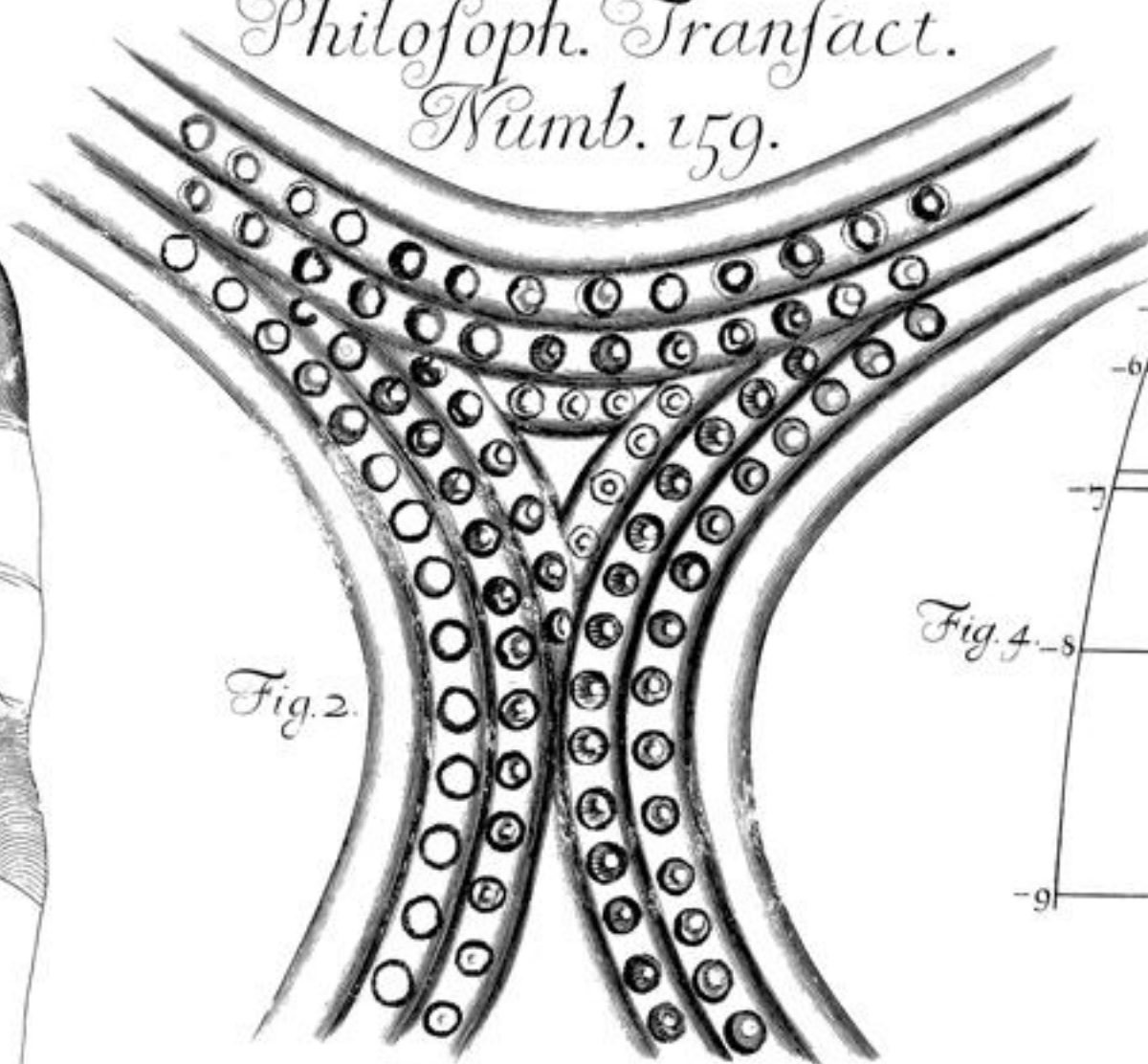
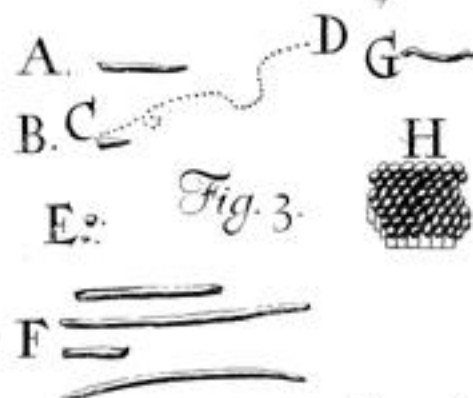
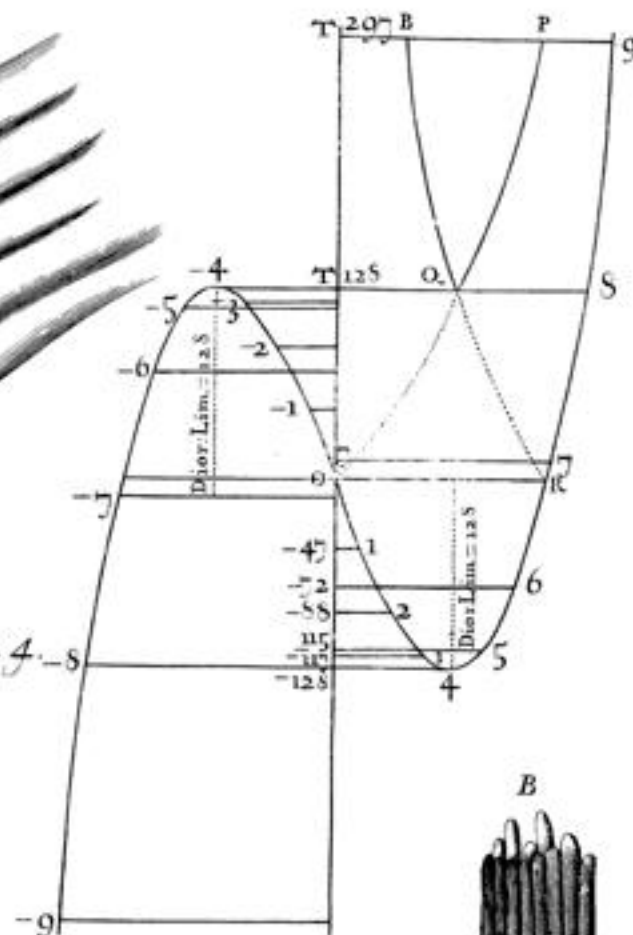


Fig. 4.



Aburg. sculp.

